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# Dietary Interventions to Treat Type 2 Diabetes in Adults with a Goal of Remission: An Expert Consensus Statement from the American College of Lifestyle Medicine

Abstract: Objective: *The objective of this Expert Consensus Statement is to assist clinicians in achieving remission of type 2 diabetes (T2D) in adults using diet as a primary intervention. Evidence-informed statements agreed upon by a multi-disciplinary panel of expert healthcare professionals were used.* Methods: *Panel members with expertise in diabetes treatment, research, and remission followed an established methodology for developing consensus statements using a modified Delphi process. A search strategist systematically reviewed the literature, and the best available evidence was used to compose statements regarding dietary interventions in adults 18 years and older diagnosed with T2D. Topics with significant practice variation and those that would result in remission of T2D were prioritized. Using an iterative, online process, panel members expressed levels of agreement with the statements, resulting in classification as consensus, near-*

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*consensus, or non-consensus based on mean responses and the number of outliers.*
Results: *The expert panel identified 131 candidate consensus statements that focused on addressing the following high-yield topics: (1) definitions and basic concepts; (2) diet and remission of T2D; (3) dietary specifics and types of diets; (4) adjuvant and alternative interventions; (5) support, monitoring, and adherence to therapy; (6) weight loss; and (7) payment and policy. After 4 iterations of the Delphi survey and removal of duplicative statements, 69 statements met the criteria for consensus, 5 were designated as near consensus, and 60 were designated as no consensus. In addition, the consensus was reached on the following key issues: (a) Remission of T2D should be defined as HbA1c <6.5% for at least 3 months with no surgery, devices, or active pharmacologic therapy for the specific purpose of lowering blood glucose; (b) diet as a primary intervention for T2D can achieve remission in many adults with T2D and is related to the intensity of the intervention; and (c) diet as a primary intervention for T2D is most effective in achieving remission when emphasizing whole, plant-based foods with minimal consumption of meat and other animal products. Many additional statements that achieved consensus are highlighted in a tabular presentation in the manuscript and elaborated upon in the discussion section*. Conclusion: *Expert consensus was achieved for 69 statements pertaining to diet and remission of T2D, dietary specifics and types of diets, adjuvant and alternative interventions, support, monitoring, adherence to therapy, weight loss, and payment and policy. Clinicians can use these statements to improve quality of care, inform policy and protocols, and identify areas of uncertainty.*

Keywords: Type 2 diabetes; Remission; Plant-based diet; Dietary intervention; Expert consensus; Delphi method

## Introduction

Type 2 diabetes (T2D) affects an estimated 10.5% of adults in the US,[1] with increasing prevalence in younger age groups[2,3] and approximately 21% of those individuals with diabetes being undiagnosed.[1] Without adequate treatment and management, the condition can result in blindness, kidney disease, cardiovascular diseases including atherosclerosis and heart failure, and other comorbidities that diminish quality of life and contribute to mortality rates.[4,5] The total cost of diabetes per year is estimated to be $327 billion ($237 billion in direct costs and $90 billion in decreased productivity).[6] From both a public health and healthcare cost perspective, the need to reduce the prevalence of T2D is urgent.

Remission, which in broad terms implies the disappearance of signs and symptoms, should be a top priority for individuals with T2D. Implicit in the concept of remission is the possibility of disease relapse or recurrence, unlike the complete and permanent disappearance associated with cure. Whereas most clinicians agree that remission is an optimal goal, discussion is ongoing around how remission should be defined in terms of glycemia, which individuals can achieve it, how it can be sustained, the minimum time duration required, and the role of dietary change as a primary intervention.[7]

The American College of Lifestyle Medicine (ACLM) endorses remission as the clinical goal in treating T2D that is optimally attained using a whole-food, plant-based (WFPB) dietary pattern, emphasizing unrefined plant foods while eliminating or minimizing animal foods and refined foods, coupled with moderate exercise.[8] While not all guidelines for T2D specifically focus on a WFPB approach or use diet as a primary intervention for achieving remission, most other organizations consider dietary intervention to be an important aspect of overall T2D management.[9-11] Recommendations regarding diet and nutrition typically emphasize weight loss (if overweight or obese), healthy foods (e.g., low fat, high fiber, and whole grain), and caloric restriction often focusing on macronutrient and micronutrient composition.[9-11] Moreover, nutrition therapy is usually not discussed in the context of remission, but rather as a means of improving glycemic control as an adjunct to pharmacologic therapy, reducing cholesterol levels, achieving body weight goals, and delaying or preventing complications.[12-14]

In contrast to dietary intervention, bariatric/metabolic surgery is commonly recognized as an effective means of achieving T2D remission by inducing significant weight loss and reducing insulin resistance.[15] While this treatment can induce remission in approximately 25% to 80% of targeted patients,[16] it carries risk and its effectiveness wanes as subjects regain lost weight.[17] More recent research suggests that sufficiently intensive lifestyle intervention (intensive therapeutic lifestyle change)—particularly diet, exercise, and sleep—may be comparable to bariatric surgery for inducing remission, but without the potential for side effects associated with such metabolic surgery.[8,18] Insufficiently dosed lifestyle change is often ineffective, while more robust dosing (more dramatic and intensive change) produces remission rates equivalent to bariatric surgery.[19,20]

Given the absence of definitive research evidence upon which to base remission-focused treatment, ACLM convened a multidisciplinary, expert panel on T2D remission to develop expert consensus statements (ECS) relevant for practicing clinicians. We used established, and validated, methodology[21] to craft statements that could reduce uncertainty and address evidence gaps relating to dietary intervention as a primary means of achieving T2D remission. Each statement was rigorously assessed for consensus, near-consensus, or no consensus using an iterative Delphi method based on mean levels of agreement and the extent of outlier opinions. Although ACLM's position statement on T2D remission[8] does address this issue, we sought to expand the scope, validity, and generalizability of knowledge by engaging a multidisciplinary panel of

experts, with diverse views and backgrounds, to synthesize current best evidence and clinical experience into areas of consensus that could improve quality of care. The choice of developing an expert consensus statement as opposed to a clinical practice guideline was made because of the limited/emerging level of evidence around dietary lifestyle interventions for T2D remission in terms of high-quality randomized controlled trials, systematic reviews, and prospective cohort studies. To the authors' knowledge, there was no a priori multidisciplinary agreement on the role of diet as a primary intervention for a goal of remission in T2D, and it was felt that establishing consensus on this and related aspects, including the definition of remission, would be a precursor to developing a clinical practice guideline.

## Methods

This ECS was developed according to an *a priori* protocol[21] with the following steps: (1) define the subject of the ECS as use of dietary interventions to treat T2D in adults with the goal of remission, (2) recruit the expert panel, (3) vet potential conflicts of interest among proposed expert panel members, (4) perform a systematic literature review, (5) determine the scope and population of interest for the ECS, (6) develop topic questions and consensus for statements for each topic question, (7) develop and implement modified Delphi method surveys, (8) revise the ECSs in an iterative fashion based on survey results, and (9) aggregate the data for analysis and presentation. The statements developed through this iterative voting process represent the research results of this method. The pertinent details of these steps are briefly described under the subheadings that follow.

### Determination of Dietary Interventions to Treat T2D with the Goal of Remission as the Topic of an ECS and Expert Panel Recruitment and Vetting

Dietary interventions to treat T2D in adults with the goal of remission was proposed for an ECS by the ACLM Research Committee. After deliberation, ACLM approved and prioritized the suggestion; the expert panel leadership was selected, and administrative support was allocated. Expert panel membership was strategically cultivated to ensure appropriate representation of relevant stakeholder groups and organizations within ACLM. Relevant stakeholders external to ACLM were contacted regarding the consensus statement project, requirements for participation, and desired qualifications for expert panel membership; each external group then nominated its representative content expert to participate. These experts were confirmed by the project leadership after review of their qualifications and potential conflicts of interest.

The ECS expert panel included representatives from the American Association of Clinical Endocrinology (AACE), the American Academy of Family Physicians, the American College of Cardiology, the American Heart Association, the Academy of Nutrition and Dietetics (AND), and the Endocrine Society (ES). Internal ACLM stakeholder groups represented by the expert panel members included physicians, dietitians, pharmacists, nurses, and researchers. The representative from the ACLM Research Committee and the requested observing representative from the AND were nonvoting members of the expert panel. Leadership for the project included ACLM members, with Richard Rosenfeld as chair and methodologist, John Kelly as assistant chair, and Micaela Karlsen as primary staff liaison.

All expert panel members are in active clinical practice or research, are content experts in dietary interventions to treat T2D, and agreed in advance of the appointment to participate in all verbal discussions (performed via web conference) and votes. Once the expert panel was assembled, the complete disclosure of potential conflicts of interest was reported and vetted. Conflicts of interest were consistent with the Council of Medical Specialty Societies' *Code for Interactions With Companies*,[22] which requires that the chair and a majority of the participants do not have a direct conflict with the deliberations. The expert panel chair and assistant chair led the development of the consensus statements and the Delphi process with input from a senior consultant/methodologist from ACLM leadership and with administrative support from an ACLM staff liaison and an independent consultant, who had prior experience with multiple ECS projects using the same methodology.

### Literature Review and Determination of the Scope of the Consensus Statement

The scope of the ECS was agreed upon during the first meeting of the expert panel using the standard PICO format of population, intervention, comparison, and outcomes. The target *population* was non-pregnant adults, aged 18 years or older, with T2D. The primary *intervention* was dietary regimens (with or without other lifestyle behavior change), including caloric restriction, macronutrient balance (fat, carbohydrate, and protein) diets, fasting protocols, and plant-forward or other specific dietary patterns. The *comparison* was optional, but if present, could include an alternate dietary intervention, standard American diet, or no change from the present diet. The *outcome* was remission in the absence of other long-term adverse effects due to the intervention, with a preliminary definition as achieving normal glycemic measures for a specified time period with no active pharmacologic therapy for glucose reduction. In defining the scope, the expert panel agreed to no longer qualify remission as partial or complete (but simply as *remission*) and to avoid using the more ambiguous term of disease reversal (again, focusing only on remission).

We developed a search strategy to identify all recently published major stakeholder guidelines (e.g., clinical practice guidelines, consensus statements, and position statements), systematic reviews, meta-analyses, and randomized controlled trials (RCTs) on diet or nutrition recommendations for

**Table 1.**

Included Articles Relevant to Dietary Interventions and T2D Remission.

| Type of Publication | # Included |
|---|---|
| Randomized controlled trial | 18 |
| Nonrandomized intervention study | 8 |
| Observational study | 3 |
| Systematic review or meta-analysis | 7 |
| Case reports/case series | 7 |
| Clinical practice guideline | 0 |
| Position statements from collaborating/relevant organizations | 3 |
| Full text not available or not available in English | 3 |

people with T2D with a focus on remission (Table 1). The search was conducted in the PubMed database for publications dating from January 1, 2010, to October 2, 2020, by 2 team members (KC and MK) with oversight from a research librarian. The search was updated through November 18, 2020, with additional search terms for observational studies and case reports/case series that included remission as a defined outcome. The search was then updated a second time through September 8, 2021. In addition, these searches were augmented with a manual search for other papers suggested by members of the expert panel. The search was not restricted to human studies, and no language restrictions were applied. Search strategies are presented in Supplementary Tables S1 and S2.

After completing all searches, the citations identified, including abstracts, were uploaded to Endnote, and duplicates were removed. The titles and abstracts for all references were screened for relevance independently by 2 team members (MK and KC) using Rayyan abstract screening software[23] and EndNote. Abstracts were excluded if they were not focused on diet, were not focused on T2D or relevant preconditions, or had no mention of or relevance to remission of T2D. When no abstract was available for screening, the decision was made to include the document for the full-text screening. Decision conflicts were resolved by consensus between the 2 reviewers. PubMed results were cross-checked against prominent point-of-care resources (i.e., DynaMed, BMJ Clinical Medical Journal, and ClinicalKey) to ensure no major stakeholder guidelines focused on diabetes remission were missing. Any additional relevant documents were added to the search results list. Finally, the most recent dietary guidance documents for diabetes prevention, management, or treatment (regardless of mention of diabetes remission) from collaborating organizations were included after manual searching and referrals from expert panel members.

We further solicited expert evidence[24] from panel members with clinical experience in managing adults with T2D using dietary interventions, recognizing that this experience, when collected a priori and in a consistent manner, could be a valid and valuable way to enrich our conversations. Expert evidence was collected with a standard form asking panelists to describe their patient population, interventions used (including a comparison group, if present), T2D outcomes measured, and their perceived or measured impact of dietary intervention on outcomes. Information from panelists who responded was collated, disseminated to the panel, and is included in the supplementary materials for this ECS.

Once the target population and scope of practice were determined, the expert panel used the results of the literature searches and the summary of expert evidence, combined with their experience and perceived stakeholder needs, to propose topics relevant to the PICO statement for key opportunities to address controversial clinical issues, reduce variability in care, clarify evidence gaps, or improve quality of care through structured expert consensus. The topic list was then consolidated, for brevity and to avoid redundancy, and the expert panel members ranked them by perceived importance using an electronic survey. The highest priority topics were then used to develop one or more related statements for which consensus would be assessed using the modified Delphi survey method. Before the survey, the leadership consolidated the statements, ensured consistent wording with unambiguous language, and obtained feedback from the expert panel regarding any edits or additions. The final agreed-upon list of statements was organized by subtopic and used for the first Delphi survey.

## Delphi Survey Method Process and Administration

A modified Delphi survey method was utilized to assess consensus for the proposed statements,[21] using web-based software (www.QuestionPro.com) to administer confidential surveys to expert panel members. The survey period was initially planned to have 3 Delphi rounds, and 1 additional survey was added for follow-up. All answers were deidentified and remained confidential to expert panel members; however, names were collected by staff to ensure proper follow-up, if needed.

According to the outcomes of the top-ranked topic list choices and resulting discussion, the expert panel chair and assistant chair developed the first Delphi survey. Prior to dissemination

to the expert panel, the Delphi surveys were reviewed by the methodologist for content and clarity. Questions in the survey were answered with a 9-point Likert scale, where 1 = strongly disagree, 3 = disagree, 5 = neutral, 7 = agree, and 9 = strongly agree. The surveys were distributed, and responses were aggregated, distributed back to the expert panel, discussed via webinar, and revised, if warranted. The purpose of the webinars was to provide an opportunity to clarify any ambiguity, propose revisions, or drop any statements recommended by the expert panel. Four meetings in total were conducted.

### Criteria for Consensus

The criteria for consensus were established *a priori* as follows:[21]

- Consensus: statements achieving a mean score of 7.00 or higher and having no more than 1 outlier, defined as any rating 2 or more Likert points from the mean in either direction
- Near consensus: statements achieving a mean score of 6.50 or higher and having no more than 2 outliers
- No consensus: statements that did not meet the criteria of consensus or near consensus

Four iterations of the Delphi survey were performed. All group members completed all survey items. The expert panel extensively discussed (via virtual conference) the results of each item after the first Delphi survey. Items that did not meet consensus were discussed to determine if wording or specific language was pivotal in the item not reaching consensus. The second iteration of the survey was used to reassess items for which there was near consensus and for which there were suggestions for significant alterations in wording that could have affected survey results. As with the first round, items that did not meet consensus were discussed to determine if wording or specific language was pivotal in the item not reaching consensus. The third iteration of the survey was used to finalize only 3 statements for which there had been near consensus. The fourth iteration of the survey contained a single question to respond to current new literature[25] on defining T2D remission.

## Results

The formal literature search produced 280 abstracts for screening after removing duplicates.

After screening, a total of 49 articles were included for full-text review. Table 1 lists included articles by publication type.

Additionally, recommendations or results from manual searching of the most recent, relevant position statements or other guidance documents from the collaborating organizations were reviewed by the panel to inform the process.

The expert panel proposed 48 topics as relevant to the ECS, which upon further discussion resulted in 131 statements under the following subtopics: definitions and basic concepts (n = 30 statements); diet and remission of T2D (n = 39); dietary specifics and types of diets (n = 22); adjuvant and alternative interventions (n = 13); support, monitoring, and adherence to therapy (n = 13); weight loss (n = 9); and miscellaneous (n = 5). After the first Delphi survey, 17 statements that reached near consensus were revised to improve clarity and 1 statement was discussed further, prior to inclusion for voting in the second Delphi round. After the second Delphi survey, 3 statements that reached near consensus were revised for clarity and included in the third Delphi survey. The fourth Delphi survey statement reached consensus.

All items reaching consensus were accepted except for 1 statement that was removed because of redundancy. The factors leading to the remaining items not reaching consensus were not attributed to ambiguous wording, inadequate discussion, or other modifiable factors but rather a true lack of consensus. After 4 iterations of the Delphi survey and removal of duplicative and similar statements, 69 statements met the standardized definition for consensus (Tables 1-7), and 60 did not (Supplementary Tables). The consensus statements were organized into specific subject areas.

### Definitions and Basic Concepts

Eleven statements reached consensus regarding definitions and basic concepts (Table 2). Two statements reached near consensus, and 17 statements did not reach consensus (Table S3).

The expert panel reached consensus that "remission of disease, such as T2D, is broadly defined as the disappearance of related signs and symptoms for a specified minimum time but does not exclude the possibility of recurrence." Consensus was reached that "remission of T2D should be defined as HbA1c <6.5% for at least 3 months with no surgery, devices, or active pharmacologic therapy for the specific purpose of lowering blood glucose," consistent with the timeline for remission as published in 2021 by the American Diabetes Association (ADA).[25] The expert panel had initially reached consensus on a minimum threshold of 6 months for remission, but had not voted on any shorter duration in the Delphi process. After the new ADA threshold of 3 months was published, the panel considered this in a fourth, and final, Delphi round in which the statement achieved strong consensus (Table 2).

Consensus was reached that remission is the optimal outcome for adults with T2D. The group also agreed that remission is a realistic and achievable goal for some, but not all, adults with T2D. The expert panel endorsed that preventing the long-term known microvascular and macrovascular complications related to diabetes is paramount, even in the absence of remission.

There was consensus that insulin resistance can be measured using homeostatic model assessment for assessing insulin resistance (HOMA-IR) and/or homeostatic model assessment for assessing beta-cell function (HOMA-beta) to evaluate progress with

**Table 2.**

Definitions and Basic Concepts: Statements that Reached Consensus.

| Number* | Statement | Mean | Outliers |
|---|---|---|---|
| 1 | Remission of disease, such as T2D,[a] is broadly defined as the disappearance of related signs and symptoms for a specified minimum time, but does not exclude the possibility of recurrence | 7.64 | 1 |
| 2 | Remission of T2D requires achieving, for a specified minimum time, normal glycemic measures, defined as normal HbA1c[b] and normal fasting blood glucose with no surgery, devices, or active pharmacologic therapy for the specific purpose of lowering blood glucose | 8.43 | 0 |
| 7 | Remission of T2D is defined as normal glycemic measures (normal HbA1c and normal fasting glucose) for at least 6 months with no surgery, devices, or active pharmacologic therapy for the specific purpose of lowering blood glucose | 7.36 | 1 |
| Follow-up 1B | Remission of T2D should be defined as HbA1c < 6.5% for at least 3 months with no surgery, devices, or active pharmacologic therapy for the specific purpose of lowering blood glucose | 7.90 | 0 |
| 10 | Remission of T2D should include a specific threshold or cut point for HbA1c | 7.93 | 0 |
| 11 | Remission of T2D requires HbA1c < 6.5% | 7.64 | 1 |
| 14 | Remission is the optimal outcome for adults with T2D | 8.36 | 0 |
| 16 | Remission is a realistic and achievable goal for some adults with T2D | 7.71 | 1 |
| 22 | Preventing the long-term known microvascular and macrovascular complications related to diabetes are paramount in managing T2D, even in the absence of remission | 8.57 | 0 |
| 26 | Insulin resistance can be measured using HOMA-beta[c] and HOMA-IR[d] to assess progress with therapy and to define expectations | 7.79 | 1 |
| 27 | Remission of T2D is accompanied by reversal or improvement of insulin resistance | 7.79 | 1 |

*Number in the initial list of candidate statements.
[a]Type 2 diabetes
[b]Hemoglobin A1c.
[c]Homeostatic model assessment for assessing beta-cell function.
[d]Homeostatic model assessment for assessing insulin resistance.

therapy and to define expectations. The expert panel agreed that remission of T2D is accompanied by reversal or improvement of insulin resistance, the context in which beta-cell dysfunction occurs.

## Diet and Remission of T2D

Eighteen statements reached consensus regarding diet and remission of T2D (Table 3). There were 21 statements that did not reach consensus (Table S4).

Agreement was reached that diet as a primary intervention for T2D can achieve remission in many adults, including those with a normal body mass index (BMI), and that it is the foundation for management, combined with medical (pharmacological therapy) as needed. The expert panel agreed that a dietary intervention's ability to produce remission was related to its intensity, defined by its dietary restrictions and degree of patient–practitioner interactions, with high fiber content being an essential component. Further, the likelihood of remission would be greatest when the dietary intervention was accompanied by other lifestyle changes and the patient's T2D was of short-term duration (4 years or under).

Agreement was reached that a very-low energy diet as an initial intervention *can* achieve remission, but an agreement was not reached that energy restriction or very-low energy content were essential components of achieving remission. The expert panel agreed that beyond T2D remission, diet as a primary intervention can also lower the risk of cardiovascular disease and improve the lipoprotein profile. Dietary

**Table 3.**

Diet and Remission of T2D: Statements that Reached Consensus.

| Number* | Statement | Mean | Outliers |
|---|---|---|---|
| 30 | Diet as a primary intervention for T2D[a] can achieve remission in many adults with T2D | 7.36 | 1 |
| 31 | Diet as a primary intervention for T2D can achieve remission in some adults with T2D | 7.86 | 1 |
| 32 | Diet is the cornerstone for managing T2D and can be used in combination with medical therapy for achieving remission of T2D | 8.21 | 1 |
| 36 | Medical therapy must be accompanied by dietary intervention for achieving remission of T2D | 7.21 | 1 |
| 37 | The intensity of a dietary intervention for T2D is determined by the degree of dietary restrictions imposed and by the frequency and duration of patient contact or counseling | 7.93 | 0 |
| 38 | The ability of diet as a primary intervention to achieve remission of T2D is related to the intensity of the intervention | 8.43 | 1 |
| 39 | A dietary intervention with low or moderate intensity is less likely to result in remission of T2D than a dietary intervention with high intensity | 8.07 | 1 |
| 40 | A dietary intervention of high intensity can result in remission of T2D | 8.29 | 0 |
| 43 | Dietary intervention accompanied by other lifestyle changes can be more effective in achieving remission of T2D than dietary intervention alone | 8.43 | 0 |
| 45 | Dietary intervention for T2D should not have any short-term or long-term adverse effects or potentially worsen other chronic health conditions | 8.36 | 1 |
| 46 | Dietary intervention for sustained remission of T2D should be evidence-based and ideally acceptable to most patients | 8.40 | 0 |
| 47 | Diet as a primary intervention for T2D can achieve remission for disease of short-term duration (4 years or under) | 7.64 | 0 |
| 50 | Very-low-energy diets as an initial intervention can achieve remission of T2D | 7.90 | 0 |
| 57 | Fiber content is an essential characteristic of dietary intervention for remission of T2D | 7.50 | 1 |
| 62 | Diet as a primary intervention may achieve remission of T2D in non-pregnant adults with obesity | 8.00 | 1 |
| 63 | Diet as a primary intervention can achieve remission of T2D in non-pregnant adults with a normal BMI[b] | 7.21 | 1 |
| 64 | Diet as a primary intervention to promote remission of T2D can also lower the risk of cardiovascular disease | 8.50 | 0 |
| 65 | Diet as a primary intervention to promote remission of T2D can also improve the lipoprotein profile | 8.36 | 1 |

*Number in the initial list of candidate statements.
[a]Type 2 diabetes.
[b]Body mass index.

interventions for T2D should not cause any adverse health effects or worsen any chronic conditions. Consensus was not achieved that reducing calories with or without liquid meal replacements should be a primary intervention to achieve remission, that very low carbohydrate diets can achieve remission, or that there was an ideal diet or ideal composition of

**Table 4.**

Dietary Specifics and Types of Diets: Statements that Reached Consensus.

| Number* | Statement | Mean | Outliers |
|---|---|---|---|
| 68 | Reducing calorie intake can be achieved by reducing food volume, portion size, energy density, or a combination of these approaches | 8.71 | 0 |
| 70 | Dietary intervention for T2D[a] should emphasize unrefined carbohydrates for the carbohydrate component of the diet | 8.21 | 1 |
| 72 | Dietary intervention for T2D may include some liquid meal replacements to facilitate patient adherence to a calorie-restricted diet | 8.10 | 0 |
| 73 | Dietary interventions may be similar for achieving initial remission and sustaining prolonged remission of T2D | 7.29 | 0 |
| 74 | Dietary interventions may differ for achieving initial remission and sustaining prolonged remission of T2D | 7.21 | 1 |
| 75 | A whole-food, plant-based diet is defined as a diet composed primarily of whole grains, vegetables, legumes, fruits, nuts, and seeds while avoiding or minimizing animal foods and refined foods including added fats | 8.43 | 0 |
| 77A | Diet as a primary intervention for T2D is most effective in achieving remission when emphasizing whole, plant-based foods with minimal consumption of meat and other animal products | 7.60 | 1 |
| 77B | Diet as a primary intervention for T2D is most effective in achieving remission when emphasizing whole, plant-based foods | 8.00 | 1 |
| 78 | A whole-food, plant-based diet is more effective than a standard American diet in promoting remission of T2D | 8.64 | 0 |
| 79 | A low-fat, whole-food, plant-based diet can often sustain remission of T2D | 8.30 | 0 |
| 81 | Limits on energy-rich and carbohydrate-rich plant foods (e.g., nuts, seeds, grains, and starchy vegetables) may be necessary to produce the weight loss for remission of T2D | 7.29 | 1 |
| 84 | Healthy, food-based dietary interventions (e.g., Mediterranean, DASH,[b] whole-food plant-based diets) are preferable to calorie or isolated nutrient restriction (e.g., low carbohydrate, low fat, and high protein) for long-term (sustained) remission of T2D | 8.21 | 0 |
| 85 | The intensity and pace of medication de-escalation(s) required will be dependent upon the intensity of the lifestyle intervention(s) for achieving remission of T2D | 8.07 | 1 |
| 86 | The risk of adverse events, including the potential to cause or exacerbate chronic disease and to increase cardiovascular risk, should influence the choice of diet as a primary intervention for remission of T2D | 8.29 | 1 |
| 87 | A very-low-carbohydrate diet can be associated with significant adverse events and cardiovascular risk that make this diet inadvisable for long-term remission of T2D | 8.43 | 0 |
| 88 | Dietary intervention for sustained remission of T2D should minimize ultra-processed foods | 8.14 | 0 |

*Number in the initial list of candidate statements.
[a]Type 2 diabetes.
[b]Dietary Approaches to Stop Hypertension (Diet).

**Table 5.**

Adjuvant and Alternative Interventions: Statements that Reached Consensus.

| Number* | Statement | Mean | Outliers |
|---|---|---|---|
| 90 | Dietary intervention in conjunction with physical activity is more likely to promote remission of T2D[a] than dietary intervention alone | 8.50 | 0 |
| 91 | Dietary intervention should be combined with other lifestyle interventions, such as regular exercise, for achieving remission of T2D | 8.64 | 0 |
| 92 | Whereas diet alone can achieve remission of T2D, modifications to other lifestyle behaviors should be incorporated, whenever possible, as part of a comprehensive lifestyle intervention | 8.29 | 0 |
| 94 | A whole-food, plant-based diet with intermittent fasting or time-restricted feeding could achieve remission of T2D in some patients | 7.50 | 0 |

* Number in the initial list of candidate statements.
[a]Type 2 diabetes.

macro or micronutrients for achieving remission.

## Dietary Specifics and Types of Diets

Sixteen statements reached consensus regarding dietary specifics and types of diets (Table 4). One statement reached near consensus, while 8 statements did not reach consensus (Table S5).

The committee reached consensus that calorie reduction could be achieved by reducing food volume, portion sizes, or energy density, using liquid meal replacements or by combining these approaches. Several statements reached consensus regarding the types of diets that are most effective in achieving remission. There was consensus that dietary intervention should include primarily whole, plant foods (whole grains, vegetables, legumes, fruits, nuts, and seeds) while avoiding or minimizing meat (and other animal products), refined foods, ultra-processed foods, and foods with added fats. This plant-forward approach was deemed better than a standard American diet in promoting remission of T2D. In addition, the panel agreed that food-based dietary interventions (e.g., Mediterranean, DASH,[2] whole food, plant-based diets) are preferred for long-term (sustained) remission of T2D.

The panel agreed that low-fat, whole food, plant-based diets can often sustain T2D remission, although there was only near consensus regarding the need to qualify these as low-fat. In addition, the panel agreed that the risk of adverse events, including the potential to cause or exacerbate chronic disease and to increase cardiovascular risk, should influence the choice of diet used to achieve remission of T2D.

Consensus was not reached regarding the inclusion of small amounts of animal foods, the occasional use of refined carbohydrates, or the complete elimination of ultra-processed foods in diabetes remission diets. The panel did not reach consensus regarding the level of energy restriction required for the initial diet phase. In addition, the panel failed to reach consensus regarding the ability of whole-food, plant-based diets *without* calorie restriction, calorie counting, or portion control, to sustain T2D remission.

## Adjuvant and Alternative Interventions

Four statements about adjuvant and alternative interventions reached consensus regarding diet and remission of T2D (Table 5), and 9 did not reach consensus (Table S6). Panel members agreed that while dietary intervention alone could achieve remission of T2D, dietary intervention should be combined with physical activity to optimize remission outcomes and that all lifestyle-related behaviors should be addressed where possible. Statements that did not achieve consensus centered on the relative contributions of dietary interventions vs intermittent fasting or time-restricted feeding vs bariatric surgery or medical (pharmacological) therapy.

## Support, Monitoring, and Adherence to Therapy

Thirteen statements reached consensus on self-management support and monitoring to achieve adherence to lifestyle interventions for the remission of T2D (Table 6). These were grouped into general principles; self-management support in the form of education, including medical nutrition therapy by registered dietitians; self-management support via behavioral counseling; and self-management support with tools and devices. All proposed statements reached consensus, highlighting the key role of support and monitoring in achieving and sustaining remission of T2D. The group recognized that a comprehensive lifestyle medicine treatment plan for individuals attempting remission of T2D should include as many self-management support strategies as possible.

**Table 6.**

Support, Monitoring, and Adherence to Therapy: Statements that Reached Consensus.

| Number* | Statement | Mean | Outliers |
|---|---|---|---|
| 103 | In contrast to hypocaloric diets, whole-food, plant-based diets provide greater levels of satisfaction and better satiety among individuals following the diet for the long-term | 8.14 | 1 |
| 104 | Dietary interventions for achieving remission of T2D[a] should accommodate patient preferences and values to encourage adherence to diet | 8.07 | 1 |
| 105 | Diabetes self-management education, with an emphasis on lifestyle medicine, should ideally accompany dietary interventions for remission of T2D | 8.10 | 1 |
| 106 | Medical nutrition therapy by a registered dietitian nutritionist can support patients in sustaining remission of T2D | 7.90 | 0 |
| 107 | Medical nutrition therapy, including access to a variety of healthy, inexpensive, culturally acceptable foods and opportunities to engage in physical activity, improves lifestyle behaviors (food choices and physical activity), and therefore promotes remission of T2D | 7.93 | 0 |
| 108 | Patients who use dietary intervention for achieving remission of T2D should employ self-monitoring strategies to maximize adherence to therapy | 7.86 | 1 |
| 109 | Patients who use dietary intervention for achieving remission of T2D should be strongly encouraged to use self-monitoring strategies to maximize adherence to therapy | 8.14 | 1 |
| 110 | Patients who use dietary intervention for achieving remission of T2D should employ cognitive-behavioral strategies, such as goal setting and self-monitoring, to maximize adherence to therapy | 7.64 | 1 |
| 111 | Self-management of blood glucose levels and blood pressure can provide patients feedback on the impact of specific lifestyle change(s) and serve as a navigational guide to success in remission of T2D | 8.07 | 0 |
| 112 | Routine self-management of blood glucose levels is strongly recommended to guide appropriate, safe, and timely medication de-escalation, if relevant | 8.50 | 0 |
| 113 | A plan for medication de-escalation should include protocols for (a) identifying medication(s) that may negatively impact the success of lifestyle intervention and (b) educating patients to identify and report symptoms and/or self-monitoring values that alert a need for medication de-escalation(s) | 8.07 | 0 |
| 114 | Continuous glucose monitoring technology, when applicable, can provide timely and actionable insight to patients regarding the impact of lifestyle choices on blood sugar control to aid in the adherence to lifestyle changes | 7.71 | 1 |
| 115 | Social determinants of health can impact compliance with dietary recommendations to achieve remission of T2D, and it is extremely important to evaluate and understand them when developing dietary recommendations to achieve remission of T2D | 8.36 | 1 |

*Number in the initial list of candidate statements.
[a]Type 2 diabetes.

## Weight Loss

Three statements on weight loss reached consensus regarding diet and remission of T2D (Table 7), and 7 statements did not reach consensus (Table S7). Consensus was reached that the goal for weight loss should be a percentage decrease in baseline body weight rather than a specific weight goal and that healthcare providers' knowledge, understanding, and cultural sensitivity are essential in counseling for weight loss. Consensus on the timeline of weight loss required for remission was not reached.

**Table 7.**

Weight Loss: Statements that Reached Consensus.

| Number* | Statement | Mean | Outliers |
|---|---|---|---|
| 116 | Cultural influences on a patient's diet are important to evaluate and understand when developing and implementing dietary recommendations to achieve remission of T2D | 8.50 | 1 |
| 122 | The impact of weight loss on promoting remission of T2D is related to the percentage of weight loss rather than an arbitrary numeric threshold | 7.80 | 1 |
| 125 | Provider's knowledge, experience, and the ability for supportive (empathic) communication to patients with T2D are essential qualities to achieve success in diabetes remission | 8.00 | 0 |

*Number in the initial list of candidate statements.
[a]Type 2 diabetes.

**Table 8.**

Payment and Policy: Statements that Reached Consensus.

| Number* | Statement | Mean | Outliers |
|---|---|---|---|
| 126 | Considering the financial impact on patients of dietary recommendations to achieve remission of T2D may increase compliance with the recommendations | 7.71 | 1 |
| 127 | Financial reimbursement models should include prevention and remission therapeutic lifestyle interventions by healthcare providers | 8.64 | 1 |
| 128 | Lifestyle change interventions should be prioritized and reimbursed at higher rates compared with current fee-for-service models that favor pharmacotherapy and limit time spent by providers to counsel patients meaningfully on adopting healthy dietary choices, implementing regular physical activity, etc. | 8.50 | 1 |
| 129 | Policy making and medical education efforts need to be realigned to recognize the value of choosing remission of T2D as the primary goal of therapy, by using therapeutic dietary and lifestyle interventions | 8.57 | 1 |

*Number in the initial list of candidate statements.
[a]Type 2 diabetes.

### Payment and Policy

Four statements about payment and policy reached consensus regarding diet and remission of T2D (Table 8). The panel agreed that the financial impact of dietary interventions on patients may affect compliance with recommendations. Agreement was also reached that financial reimbursement models using lifestyle change should be prioritized and reimbursed at higher rates than current fee-for-service process-based models, and that policy needs to be realigned to value remission of T2D as a primary clinical goal.

### Expert Evidence

Expert panel members with clinical experience in remission briefly summarized their approach, outcomes, and perspectives as expert evidence (Table S8). The evidence was heterogeneous in terms of patients, interventions, and outcomes, but did offer nuance and perspective beyond the published research for the panel to consider when assessing consensus.

## Discussion

Using a structured and validated process to assess consensus, our multidisciplinary expert panel agreed upon many statements that can guide clinicians in helping adults with T2D achieve and sustain disease remission using diet as a primary intervention. A noteworthy accomplishment was

reaching consensus on many statements, despite our expert panel's diverse backgrounds, perspectives, and organizational affiliations. While some statements may have similar but varied wording or encompass other statements, these results represent quantitatively assessed expert agreement on a topic for which research is still an emerging area. Although expert consensus can never substitute for direct research evidence, until such evidence is forthcoming, we believe that our robust process is the best way to facilitate informed decisions by clinicians and patients when action is required, despite gaps, limitations, or uncertainties regarding current research evidence. Clinicians should, of course, remain alert to new evidence that could potentially modify or impact the consensus statements outlined in this document.

## Definitions and Basic Concepts

One challenge in developing expert consensus for the remission of T2D was to agree upon the clinical implications of remission and the specific criteria necessary for this level of disease control. We reached consensus on a broad, pragmatic definition of remission of disease, such as T2D (Table 2) as ". . . the disappearance of related signs and symptoms for a specified minimum time but does not preclude the possibility of recurrence." With regards to specific criteria (Table 2), remission of T2D was defined as "HbA1c <6.5% for at least 3 months with no surgery, devices, or active pharmacologic therapy for the specific purpose of lowering blood glucose." These broad and more specific definitions of remission are easy to apply, provide a clear and pragmatic basis for consistent communication, and emphasize why (Table 2) "Remission is the optimal outcome for adults with T2D." Remission is also a beneficial goal for health systems, as it can provide a metric for the success of population health measures and resource allocation.

There is substantial heterogeneity in the literature regarding a single accepted definition of T2D remission, and this was also reflected in our statements that achieved consensus. This diversity, in part, relates to historical decisions[26] to categorize remission as "complete" vs "partial," a distinction that some, including our panel, consider arbitrary, unnecessary, overly complicated, and confusing to clinicians and patients. We therefore made an early decision to focus our attention on remission without further qualification.

Historically, Buse and colleagues,[26] in *Diabetes Care* in 2009, together with the Association of British Clinical Diabetologists (ABCD) and the Primary Care Diabetes Society (PCDS),[27] outlined T2D remission as "partial" (defined as sub-diabetic hyperglycemia (HbA1C not diagnostic of diabetes [< 6.5%], fasting glucose 100–125 mg/dl [5.6–6.9 mmol/l]) of at least 1 year's duration in the absence of active pharmacologic therapy or ongoing procedures) or "complete" (HbA1C in the normal range of < 5.7%, fasting glucose < 100 mg/dl [5.6 mmol/l]) of at least 1 year's duration in the absence of active pharmacologic therapy or ongoing procedures). Furthermore, the report also defined "prolonged" remission as complete remission that lasts for more than 5 years. The ADA in 2021, however, together with the Endocrine Society, the European Association for the Study of Diabetes, and Diabetes UK published a consensus report with their definition that "remission should be defined as a return of HbA1c to <6.5% (<48 mmol/mol) that occurs spontaneously or following an intervention, and that persists for at least 3 months in the absence of usual glucose-lowering pharmacotherapy."[25] Some experts have noted that a definition of remission that includes surgery, which cannot (normally) be undone, can seem disingenuous since the therapy is always ongoing. The same, however, can be said about lifestyle changes, which must be ongoing to sustain remission.

Our consensus statements defining remission are largely consistent with the current ADA definition and aligns with those previously proposed by ABCD and the PCDS,[27] which previously defined remission in their position statement as achieving "all three of the following criteria: (1) weight loss; (2) fasting plasma glucose or HbA1c below the WHO diagnostic threshold (<7 mmol/L/126 mg/dL) or <48 mmol/mol/6.5%, respectively) on two occasions separated by at least 6 months; (3) the attainment of these glycaemic parameters following the complete cessation of all glucose-lowering therapies." Our definition of remission in follow-up question 18 is closely aligned with the ADA, while other statements achieving consensus overlap with previously discussed historical definitions, mentioning symptoms, blood glucose levels, and duration of time without medications. We did not, however, consider "weight loss" to be a necessary criterion. Similarly, in developing their recent position statement,[25] the ADA authors developed a single definition of remission (defined as non-diabetic glycemic thresholds as opposed to "partial" or "complete"), without mention of weight loss, "in order to simplify healthcare coding as well as for purposes of patient education and incentivizing patients' diligent lifestyle efforts."

Our expert panel recognized the limitation that many studies of T2D remission are among people with relatively recent-onset diabetes, and therefore, recommended that remission should be defined as a realistic and achievable goal for many adults with T2D using diet as a primary intervention (Table 3). For individuals who have had T2D of long-standing (8 years or more) duration (often with multiple microvascular or macrovascular complications), remission may be harder to achieve due to significant beta-cell exhaustion/depletion.[28] For this reason, the expert panel reached consensus that (Table 2) "Insulin resistance can be measured using HOMA-beta and HOMA-IR to assess progress with therapy and to define expectations."

Individuals who have low beta-cell function at baseline might be predicted to have a lower likelihood of going into remission, while individuals with high beta-cell function and good HOMA-beta recovery during lifestyle therapy may be

predicted to have good chances of remission.[28] The DiRECT trial (Diabetes Remission Clinical Trial) and other studies demonstrated that weight loss, particularly > 15 kg, was associated with T2D remission. In general, weight loss from decreased calorie intake and/or increased calorie expenditure leads to decreased insulin resistance.[8] Therefore, using the homeostatic model assessment for insulin resistance (HOMA2-IR), improvement as an indicator of progress during lifestyle therapy can provide a useful metric for gauging the likelihood of remission.

The overarching goal of all T2D care is to achieve and sustain remission while preventing complications that lead to morbidity and premature mortality. To what degree dietary practices that promote remission also affect advancing complications is unknown; however, the expert panel agreed that preventing complications should be the thematic goal of all T2D management, regardless of whether remission is ultimately achieved. Therefore, therapeutic lifestyle intervention remains the cornerstone of all T2D management approaches.

## Diet and Remission of T2D

The expert panel agreed that diet as a primary intervention for T2D can achieve remission in *many* adults with T2D, of both normal and elevated BMI, and that diet is the cornerstone for managing T2D combined with medical therapy deemed necessary (e.g., oral hypoglycemic drugs or insulin). Consistent with previous findings, it was agreed that adults with short-duration T2D (4 years or under) are more likely to achieve remission than those with long-duration diabetes (8 years or more). Even if remission is less likely, however, there are no drawbacks to counseling patients with long-duration diabetes to follow a healthier diet. More research also is needed to determine which patient populations are the most likely candidates for remission.

While many medical organizations and other stakeholder groups already emphasize a healthy diet as part of diabetes management,[29-33] currently few[8] identify diet as a *primary intervention* for T2D remission. To use diet as a primary intervention, additional education and training about the effectiveness of diet may be needed among physicians, who currently do not consistently deliver diet and lifestyle advice.[34,35] Registered dietitians, who can deliver individualized nutrition therapy prescriptions for T2D patients,[36] may also need training to better focus their efforts on best approaches to achieve remission as part of their culturally sensitive patient education efforts. Remission using diet as a primary intervention has been successfully demonstrated in several settings, including both the DiRECT[37] (N = 298) and Counterpoint[38] (N = 24) trials, as well as others,[28,39,40] which used very-low-calorie diets. Data are lacking on non–energy-restricted diets, but remission has also been reported by some expert panel members in patients using a WFPB diet without calorie restriction, while for other members' patients, a focus on maintaining energy balance was needed (Table S8).

Our expert panel agreed that the ability of diet to achieve remission is related to its intensity, with low- and moderate-intensity interventions being less likely, and high-intensity interventions being most likely, to achieve remission. There was substantial discussion around the definition of intervention intensity, including restricting food groups such as meat, dairy, and refined grains, and food components such as sugar and added fat, as well as calorie restrictions. While agreement on the exact ideal diet or nutrient composition was not reached, agreement was reached that fiber promotion and calorie restriction especially for overweight/patients with obesity are essential components. Only plant foods contain fiber, and they also have significant water content (vegetables and fruits), resulting in a low-fat, low–energy-density nutrient profile if prepared without additional calorie sources,[41] as compared to animal foods which lack fiber and tend to be higher in fat and total energy.[42] This is consistent with research on overall dietary patterns which find that meat consumption increases weight gain, which in turn is associated with increased diabetes risk,[43,44] while plant-based diets are inversely associated with diabetes risk.[45,46] While the expert panel discussed ad libitum intake and did not achieve consensus that this approach works for all T2D patients pursuing remission, experimentally, a low-fat, totally plant-based diet produced less total energy consumption (689 ± 73 kcal/d) as compared to a ketogenic/low-carbohydrate diet among 20 inpatient adults in a randomized crossover trial over 2 weeks with ad libitum conditions (plant-based diet mean kcal intake: 2064 ± 157kcal/day; low-carbohydrate diet mean intake 2752 ± 210 kcal/day; $P < .0001$).[47]

Agreement was reached that diet is the cornerstone for managing T2D and that dietary interventions that are accompanied by other lifestyle changes can be more effective than diet alone. Most trials with remission outcomes did incorporate some level of added physical activity,[28,37-40] and asking patients to increase physical activity is another health behavior modification with positive side effects, as discussed in the *Adjuvant and Alternative Therapies* section.

Finally, there was no consensus on low-carbohydrate diets as a short-term or long-term intervention for T2D because of uncertainty and evidence gaps in the literature. The expert panel engaged in discussion around the cardiometabolic effects of very-low-carbohydrate diets in the first meeting and agreed to exclude "remission outcomes" that produce negative cardiometabolic side effects, even if blood glucose control appears successful. While a ketogenic diet has been shown to help maintain low blood glucose levels, the impact on insulin resistance is unclear.[8,48-50] Certain safety concerns related to potential long-term cardiometabolic effects of low-carbohydrate diets do exist,[51] although long-term studies in humans have not been conducted. In terms of long-term

adverse effects or potentially worsening other chronic health conditions, dietary patterns that lower the risk of cardiovascular disease are the same dietary patterns (high content of unrefined plant foods with minimal animal products or highly processed foods) that reduce the risk of diabetes, while dietary patterns that are calorie-dense and high in animal foods and saturated fats confer added cardiovascular risk.[52-56]

## Dietary Specifics and Types of Diets

Remission of T2D requires a sufficient reduction in absorbed calories to decrease adiposity and insulin resistance.[8,57-59] Studies consistently demonstrate that using liquid meal replacements can significantly reduce energy intake and cause weight loss.[59-61] For many individuals, however, food-based approaches are better accepted than liquid meal replacements. Food-based approaches that appear particularly effective in producing satiety without feelings of deprivation are those that reduce energy density but keep food volume high. Achieving lower energy density requires generous intakes of water-rich foods such as fruits and vegetables, and other high-fiber, low-fat foods, such as whole grains and legumes.[62-64] Plant-based dietary patterns are particularly effective in this regard. Other strategies that have been successful for reducing energy intake include very-low-calorie diets, fasting-mimicking diets, and intermittent fasting.[8] Less restrictive programs that promote modest weight loss of 5 to 10% of body weight produce clinical benefits.[32] However, for some individuals, more aggressive treatment is required to achieve remission.

Food-based approaches identified as preferable for remission (e.g., Mediterranean, DASH,[2] whole-food plant-based diets) all emphasize whole plant foods; are nutrient-dense; and rich in fiber, antioxidants, and phytochemicals.[65-68] There was also consensus that diet is most effective in achieving remission when whole, plant-based foods and unrefined carbohydrate sources are emphasized, and ultra-processed foods, meat, and other animal products are minimized. Unrefined carbohydrate sources are protective against cardiometabolic abnormalities, whereas refined carbohydrate sources increase risk.[69,70] Ultraprocessed foods, including many cheeses, processed and red meats are also typically associated with adverse cardiometabolic outcomes in people with T2D.[71-73]

Further research is needed to compare the effectiveness of whole-food, plant-based diets with varying levels of fat from high-fat plant foods such as nuts, seeds, and avocados or oils. Consensus was reached that limits on energy-rich and carbohydrate-rich plant foods (e.g., nuts, seeds, grains, and starchy vegetables) may be necessary to produce adequate weight loss. However, a recent RCT of 244 participants reported that *ad libitum*, very-low fat plant-based diets promote sufficient weight loss and hepatocellular triglyceride reductions to improve insulin sensitivity.[74]

Recognizing the importance of avoiding cardiometabolic adverse events, very-low-carbohydrate diets (e.g., ketogenic diets) were deemed inadvisable for use in long-term remission of T2D. Although very-low-carbohydrate diets appear to produce T2D remission by normalizing glycemic measures, they have failed to restore insulin sensitivity in animal models.[75-77] Very-low-carbohydrate diets are typically high in red and processed meats, which are consistently associated with increased morbidity and mortality, and, for many individuals, are not sustainable.[78,79]

In terms of dietary interventions for initial vs long-term remission, very-low-calorie diets, or liquid meal replacements are only appropriate for achieving initial remission, while more energy-balanced, whole-food diets may be suitable for both initial and sustained remission.[8] The expert panel agreed that the intensity and pace of medication de-escalation (deprescribing) depends on the intensity of the lifestyle intervention. For example, if more aggressive very-low-calorie diets or liquid meal replacements are used for the initial remission phase, medication de-escalation (deprescribing) will need to be accelerated to avoid overdosing effects.

While no consensus was achieved about small amounts of animal foods, ultra-processed foods, or energy restriction, these can be important considerations when using a patient-centered culturally acceptable approach to maximize adherence and success.

## Adjuvant and Alternative Interventions

Panel members agreed that dietary intervention should be combined with physical activity to optimize remission outcomes and that all lifestyle-related behaviors should be addressed where possible.[80] While most medical guidelines for T2D do include mention of diet and lifestyle behaviors, these recommendations do not necessarily translate to action in terms of patient messaging, counseling, and prescribing. Addressing all lifestyle behaviors, particularly diet and exercise, is likely to produce only positive (side) effects; therefore, no drawbacks exist to clinical care emphasizing healthy behaviors. Research has found a lower risk of developing T2D with increased plant-based diet consumption[43,46,81] and increased levels of physical activity.[82] Most interventions with remission outcomes have focused on diet, but several have incorporated physical activity in combination.

Consistent with the available literature, the panel agreed that intermittent fasting, time-restricted feeding, or both, combined with a whole-food plant-based diet could achieve T2D remission.[83-85] However, it was agreed that this type of intervention should be individualized and involve team members with knowledge and expertise in diabetes management to achieve the highest level of patient satisfaction and the least amount of recidivism.

In summary, while consensus was reached around whole-food, plant-centered dietary approaches for T2D

remission, certain other adjuvant interventions may be helpful and could be considered in the context of patient preferences and willingness.

## Support, Monitoring, and Adherence to Therapy

Self-management support is a fundamental tenet of the chronic care model linked to improved chronic care outcomes.[86] Education and behavioral self-management support is especially important for individuals attempting remission of T2D, on both the lifestyle interventions that can help achieve remission and the tools needed for self-monitoring of blood sugars, body weight, and physiologic symptoms during de-escalation of therapy. The expert panel recognized that self-management support is ideally delivered by diabetes care teams, including Certified Diabetes Care and Education Specialist (CDCES), registered dietitian nutritionists (RDNs), pharmacists, and other trained clinicians, in alignment with other organizations' stance that ideally care should involve a team of practitioners.[87]

The panel also agreed that diet and lifestyle strategies should be acceptable to most patients, easy to adhere to over time, accommodate patient preferences and values, and be culturally sensitive and appropriate. This concept is aligned with the AACE position that interventions should "consider the whole patient" and "be sensitive to patients' ethnic and cultural backgrounds and their associated food preferences,"[87] and the similar ADA position related to patient-centered lifestyle management.[29] This concept is also aligned with the general principles of team-based care outlined by the Institute of Medicine (IOM)[88] and the American Association of Colleges of Nursing (AACN),[89] which recognize the patient as the center of the care team which recognizes the patient as the center of the care team. Finally, as noted by the ADA, the panel agreed that interventions aimed at promoting remission of T2D should recognize that numerous social determinants of health (SDOH) influence lifestyle behaviors, often negatively, and may present barriers to implementation and/or maintenance of diabetes care in general.[90]

The group recognized the importance of patient education and knowledge for self-management support in those attempting remission of T2D. Nutrition knowledge is a key driver of diet quality.[91] Per the AACE "the clinician, a registered dietitian, or a nutritionist (i.e., a healthcare professional with formal training in the nutritional needs of people with diabetes) should discuss recommendations in plain language at the initial visit and, at least briefly, with each follow-up office visit. Discussion should focus on foods that promote health, including information on specific foods, meal planning, grocery shopping, and dining-out strategies. Patients should be instructed on proper interpretation of Nutrition Facts Labels on packaged foods."[87]

As discussed in the ACLM position statement on diabetes remission, evidence supports a WFPB diet in those attempting diabetes remission[8] and patients should be educated about the components of a WFPB diet. As above, education should be tailored to patients' ethnic and cultural backgrounds and food preferences. Registered dietitians (RDs) are ideally suited to deliver nutrition education given their focused training and evidence that they improve glycemic measures in patients with T2D,[84] but other trained personnel can provide this education if needed. In addition, patients attempting T2D remission should be educated by the team about the need for self-monitoring to recognize signs and symptoms of hypoglycemia. They should also be educated, preferably by a pharmacist or trained healthcare professional, about current medications that may negatively impact adherence to a healthier eating pattern and increased physical activity (e.g., those that cause GI disturbances or cause hypotension, hypoglycemia, myalgia, or fatigue).[87]

Intensive lifestyle treatments can quickly reduce the need for medications, and therefore, data from self-monitoring devices can be useful, if available, to guide medication de-escalation. Patient self-monitoring (of signs and symptoms of hypoglycemia and blood pressure) is a key component of self-management support in patients attempting remission of T2D. This is particularly true because medication deprescribing guidance exists for polypharmacy, adverse drug reactions, and advanced age but not specifically for lifestyle intervention.[92-94] Monitoring may include identification of symptoms (for example, dizziness) that would serve as a signal that a medication dose may need to be reduced or the medication stopped, or readings from devices such as blood glucose monitors (glucometers or continuous glucose monitors) or blood pressure monitors, especially because large proportions of those with T2D take blood pressure medications.

Self-monitoring devices improve the safety of and serve as a source of motivation for patients, as the data from these devices can provide direct and timely feedback into the impact of lifestyle treatment(s) and serve as a tracking tool. In recent years, continuous glucose monitoring (CGM) has become more available to people with T2D and has added considerable clarity to patients' and clinicians' understanding of glycemic patterns.[87]

## Weight Loss

Obesity is a major risk factor for T2D and the prevalence of T2D has closely mirrored that of obesity. In the United States, over two-thirds of the adult population have overweight or obesity, including 85% of those with diabetes. If the present trends continue, about 1 in 3 Americans will have diabetes by 2050.[95]

The panel agreed that the goal for weight loss should be expressed in terms of percent weight loss (e.g., 5% to 15% of baseline body weight), not a specific amount of weight (e.g., 5 pounds), to ameliorate insulin resistance and alleviate hyperglycemia.[96] The weight loss recommendations in percent weight loss are likely to be more applicable for all

BMI ranges than fixed weight loss goals. Healthcare providers' knowledge, understanding of cultural differences, and empathy are vital for effective weight loss counseling for the remission of diabetes.[97]

The literature suggests that weight loss can produce remission of T2D in a dose-dependent manner.[98] There was a lack of consensus on weight loss as a necessary criterion in defining remission of T2D or to recommend a specific goal for weight loss. Weight loss is not included as part of the definition of T2D remission in any of the existing definitions, and glycemic parameters may show improvement with modest weight loss and formidable targets could be overwhelming for patients.[99] Furthermore, goal setting is not standardized based on the literature and may differ based on race and ethnicity due to varying levels of insulin resistance (e.g., in Asians).[100] There was also a lack of consensus on the timeline for weight loss and remission of diabetes with intensive hypocaloric dietary intervention. The panel members agreed they can occur concurrently or sequentially, though remission is limited to adherence with dietary and lifestyle changes along with weight loss as these changes are not curative and T2D returns with weight regain.[59,101-103]

### Payment and Policy

Individuals with diagnosed T2D incur medical expenditures of approximately $16,752 per year, of which $9601 is attributed to care of their diabetes.[104] These expenditures, a large majority of which are for hospitalizations and pharmaceutical therapies, are typically covered by most health insurance companies. However, insurance coverage of nutrition prescriptions (i.e., healthy foods), intensive lifestyle therapy programs, and medically tailored meal (MTM) programs that may be used to achieve remission of T2D are rarely covered by health insurance companies. Adherence of patients to dietary recommendations is likely to increase if insurance coverage recognizes nutrition prescriptions for the remission of T2D as at least equivalent to the coverage offered for traditional pharmaceutical or medical therapies.

Our multidisciplinary expert panel reached consensus that remission of T2D is possible for many adults using diet as a primary intervention. A nutritious diet is one component of lifestyle therapies that many clinicians agree can prevent, treat, and even produce T2D remission, and that those therapies should be reimbursed by insurance companies when delivered by healthcare providers. The only widely reimbursed comprehensive lifestyle therapy program for T2D is the National Diabetes Prevention Program (National DPP), which demonstrated a reduced incidence of progression from pre-diabetes to T2D by 58% in high-risk individuals. Because diabetes remission is still not widely accepted, programs that aim to achieve remission are also not commonly covered by insurance companies. The National DPP, along with Medical Nutrition Therapy (MNT) for T2D, and Diabetes Self-Management Training (DSMT) are educational programs and training services that do not recognize or have a goal of achieving remission of T2D. These services are heavily focused on disease management training; DSMT recognizes "skills related to the self-administration of injectable drugs" in its definition,[105] and MNT is defined by the AND as nutritional diagnostic, therapy, and counseling services for disease management that are provided by an RDN.[106,107] Aside from a lack of recognition of remission of T2D, the programs are also fraught with heavy regulation, administrative burden,[105] limit the amount of services available in a beneficiary's lifetime, and are reimbursed at lower rates than other fee-for-service medical interventions.

Total maximum payment for the 2-year National DPP is currently $702 per eligible beneficiary lifetime, with the largest payments coming in the first 6 months of the program based on attendance and weight loss.[108] MNT for T2D currently can only be delivered by a licensed dietitian and is reimbursed at a lower rate than the standard fee-for-service evaluation and management codes. The financial incentive for health systems or providers to implement these administratively burdensome, comprehensive lifestyle behavioral change therapies, compared to financial incentives to administer traditional fee-for-service diagnosis and treatment, is currently very low. Considering that lifestyle therapies can achieve remission and reduce or eliminate ongoing annual costs for the management of diabetes with traditional pharmaceuticals and hospitalizations, it is the opinion of the authors that financial incentives to achieve remission should be at least equivalent to, if not higher than, traditional therapies.

## Strengths and Limitations

As the first formal consensus product of its kind, this expert consensus statement provides unique and novel information that not only raises awareness of remission as an important and achievable goal for many adults with T2D, but also offers insights on how dietary intervention can facilitate this outcome. A key strength of the process is the explicit and trustworthy methodology,[21] which has been previously tested and validated by the American Academy of Otolaryngology—Head and Neck Surgery in developing multiple consensus documents. Trustworthy methodology is especially important when assessing expert consensus to limit bias and distortions that may be introduced by panel members, particularly when conclusive research evidence is lacking.

Another key strength of this project is the multidisciplinary expert panel that included diverse stakeholders who manage adults with T2D. These experts were identified through direct outreach

to the leadership of medical societies relevant to T2D and represented the interests of these stakeholders throughout the development process. This diversity was largely responsible for the robust list of 130 consensus statement topics, which spanned nearly all aspects of managing T2D with dietary intervention, and a corresponding list of expert consensus statements (ECS), many of which achieved full consensus during the iterative Delphi process. Having an accomplished expert panel, highly regarded by their sponsoring societies or organizations, further allowed us to harness expert evidence[24] using a systematic process to reduce bias, before formulating the consensus statements. This evidence, relating to the experience of our panel in achieving T2D remission with dietary intervention, was important given the paucity of similar information in the literature.

Our efforts were limited by gaps and uncertainties in the relevant medical literature, although there were some RCTs and systematic reviews to provide useful evidence, even if not fully generalizable to our target patient population or intervention of interest (diet). We sought to enhance our understanding of dietary intervention for T2D remission beyond the limited published literature by identifying expert evidence,[24] but despite collecting this a priori with explicit data forms we cannot exclude bias, recall, or reporting errors as potential sources of distortion. The expert panel acknowledges that patients and clinicians would benefit from additional information and resources on how to promote, and sustain, remission of T2D using diet as a primary intervention, but this aspect of implementation was beyond the scope of the current research. Others will hopefully use the consensus statements in this document as a starting point for developing their own, patient-centered implementation materials.

A final potential limitation relates to the dietary patterns of our expert panel participants, which are presented in the Declaration of Conflicting Interests portion of the article. Panelists self-reported that their diets, on average, consisted of 89% plant-based foods, ranging from 50% to 100%, with most food choices described as whole or minimally processed. This high prevalence of healthy, plant-based eating, as well as our discussion focused on plant-forward dietary patterns, may have introduced bias in favor of this approach that impacted responses to the iterative Delphi surveys. We have therefore disclosed this information so the reader can draw their own conclusions.

## Conclusions

A diverse panel of experts, representing key stakeholders in managing adults with T2D, has agreed upon substantial aspects of using a WFPB dietary intervention to achieve disease remission. These statements, summarized in Tables 2–8, should help clinicians who manage adults with T2D in reaching shared decisions regarding remission as an optimal treatment outcome, the role of dietary intervention in facilitating this goal, and the specific aspects of diet and lifestyle that are most likely to result in success. Although our focus throughout was on quality improvement, including areas with evidence gaps, the consensus statements are not intended as "recommendations" for action, which are more appropriate in the context of clinical practice guideline development. Areas identified as needing further research include the role of reducing (or excluding) animal foods in promoting remission and assessing whether remission can be obtained with ad libitum food intake during a WFPB diet. There is also an ongoing need for additional randomized controlled trials to assess sustainable plant-based dietary interventions with whole or minimally processed foods, as a primary means of treating T2D with the goal of remission, as well as factors that lead to successful patient adherence and effective dissemination and implementation of such interventions.

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## Declaration of Conflicting Interests

Richard M. Rosenfeld, MD, MPH, MBA (chair/methodologist, ACLM member): 100% plant-based food, 95% whole or minimally processed; Chair, Committee on Plant-based Health and Nutrition, SUNY Downstate Health Sciences University; Sr. Liaison for Medical Society Relations at ACLM; Chief Medical Officer for American Board of Lifestyle Medicine

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Amy Rothberg, MD, PhD (representative, Endocrine Society): 80% plant-based food, 80% whole or minimally processed; REWIND, INC. virtual platform created for weight control with the goal to "defeat" T2D—I provide consultancy, Nestle-provides product, for an R01/NIDDK grant

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## Disclaimer

Expert consensus statements are based on the opinions of carefully chosen content experts and provide for informational and educational purposes only. The purpose of the development group is to synthesize information, along with possible conflicting interpretations of the data, into clear and accurate answers to the question of interest. Expert consensus statements may reflect uncertainties, gaps in knowledge, opinions, or minority viewpoints, but through a consensus development process, many of the uncertainties are overcome, a consensual opinion is reached, and statements are formed. Expert consensus statements are not clinical practice guidelines and do not follow the same procedures as clinical practice guidelines. Expert consensus statements do not purport to be a legal standard of care. The responsible physician, in light of all the circumstances presented by the individual patient, must determine the appropriate treatment, diagnosis, and management. Consideration of expert consensus statements will not ensure successful patient outcomes in every situation. The ACLM emphasizes that these clinical consensus statements should not be deemed to include all proper diagnosis/management/treatment decisions or methods of care or to exclude other treatment decisions or methods of care reasonably directed to obtaining the same results.

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